C4, cont.

jacket covering the cladding, the plastic jacket on the optical fiber length passing through the through-hole being removed thereby exposing the cladding permitting a better seal between the ceramic adhesive plug and the optical fiber.

Concl'd D3

19. (Amended) The pressure vessel of claim 18 wherein the through-hole has an inner surface with at least a portion being formed to have an irregular surface region for improved bonding with the adhesive plug.

20. (Amended) The pressure vessel of claim 18 further comprising:

a cap formed from a polymer material to encapsulate a small portion of exposed cladding extending from the adhesive plug thereby forming a fluid barrier over the surface of the plug.

REMARKS

Claims 3, 9-12 and 14-20 remain in the Application. Claims 1, 2, 4-8 and 13 have been cancelled without prejudice. Applicant respectfully requests reexamination.

Claims 3 and 4 were rejected under 35 U.S.C. § 103(a) as unpatentable over *Adl* (4 U.S. 4,834,479) in view of *Nakai, et al.* (U.S. 4,345,816). Applicant respectfully traverses *Adl* discloses a watertight assembly for an undersea optical fiber cable that includes a socket with a cavity. Optical fibers extend out of the cavity through a rubber plug which is shaped to fit into the cavity. The rubber plug seals against the optical fibers as a result of an internal compressive stress which is preloaded into the plug in order to prevent leakage of fluid around or through the rubber plug throughout a range of ocean bottom pressures. Clearly *Adl* is not directed to a high temperature resistant container. The bottom of the ocean floor tends to be cold instead of hot. Secondly, the pressure loading of *Adl* is exactly opposite to that of the claimed invention. *Adl* describes an <u>internal pressure loading</u> pushing the plug 34 snugly against a stopper barrier wall

39 and the sidewall of the socket cavity and the fibers, i.e. from the inside out, in order to seal the sidewall of the socket cavity and the fibers 37 against external hydrostatic pressure. (Col. 4, ll. 49-59.)

Nakai et al. is directed to providing a housing that allows the introduction of an optical fiber into an optical submerged repeater in a manner which prevents seawater from entering the introduction point. As shown in *Nakai*, Figures 1 and 2, the exposed portion 3 of an optical fiber having a part of this coding removed is inserted into the cavity 14 of a small diameter metal cylinder 4. The cavity 14 of the metal cylinder 4 is filled with an epoxy system adhesive 5 which completely surrounds the exposed optical fiber portion 3. Furthermore, in order to keep seawater out of the area surrounded by the epoxy adhesive 5, a small amount of vegetable oil or polyisobutalyne 6 is introduced into the cavity 14. A rubber packing 7 maintains the fluid 6 in place. A screw 8 keeps the packing 7 in place. Although the Office Action refers to reference 4 as a plug region, *Nakai* actually teaches that reference 4 is a small diameter metal cylinder of the shape shown in the figure.

Neither *Nakai* or *Adl* shows or teaches a tubular casing capable of withstanding high temperature and pressure environments, which has an internal cavity of a size sufficient to mount a component therein and which has a lead passing out of the cavity through a high temperature, high pressure resistant plug that seals against a length of the lead, the plug being specifically shaped to conform to a plug region that is greater in diameter than the diameter of the internal cavity so that when the external pressures are exerted on that plug region, the plug is compressed towards the internal cavity, thereby increasing the seal around the lead and around the plug region.

Applicant respectfully requests that this rejection be withdrawn.

Claims 9-20 were rejected under 35 U.S.C. § 103(a) as unpatentable over *Adl* and *Naki* in view of *Beyer, et al.* (U.S. 6,212,989). Applicant respectfully traverses.

Beyer, et al is directed to a high pressure, high temperature window assembly and a method of making such a window assembly. Apparently *Beyer* is being cited as a teaching for a ceramic plug. *Beyer* actually shows a window 10 as having a truncated conical geometry which is made out of sapphire or other suitable material. The window 10 is sealed into its case 30 by a truncated conical seal 20 which is made of highly ductile metal. Applicant respectfully submits that *Beyer* does not teach a pressure vessel with a ceramic plug, let alone a ceramic plug through which optical fibers pass, and still provides a high temperature, high hydrostatic pressure resistant seal.

Applicant respectfully requests that the above rejection be withdrawn.

In light of the above Amendment and Remarks, Applicant believes that the claims remaining in the Application are in condition for allowance and respectfully requests that the Application be passed to issue.

I hereby certify that this correspondence is being deposited with the United States Postal Service as Express Mail (No. EV 196887432 US) in an envelope addressed to the Assistant Commissioner for Patents, Box CPA, Washington, D.C. 20231 on December 20, 2002.

By: Sandy Malec

Sandy Malec
Signature

Date: December 20, 2002

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

Claims 3, 10, 11, 12, 14-20 have been amended as follows:

3. (Three Times Amended) An improved pressure vessel comprising:

a tubular casing capable of withstanding high temperature and pressure environments having an internal cavity and an opening in at least one end permitting access to said internal cavity[;], the opening including a plug region [followed by a hollow interior,] having a greater diameter than the diameter of the internal cavity along at least a part of its length, the plug region [being adjacent said] extending from the opening to the internal cavity; [with a plug therein, the plug and plug region having a cross section diminishing in diameter with distance from the opening; and]

a component in [said hollow interior] the internal cavity having at least a first lead [passing through said plug] required to exit the pressure vessel [said plug encapsulating said component lead and sealing said opening]; and

a high temperature, high pressure resistant plug sealing against a length of the first lead passing through the plug shaped to conform to the plug region and sealing the opening when located therein, whereby increased external pressure compresses the plug forcing it towards the internal cavity increasing the seal around the lead and around the plug region.

10. (Twice Amended) The pressure vessel of Claim [3] 9 [wherein the plug is formed from a ceramic adhesive, said plug having an external surface, and] wherein said pressure vessel further comprises: a cap[, said cap being] formed from a polymer material, said cap [to cover and extend] extending beyond the external surface of said plug thereby forming an additional [a] fluid barrier over the surface of the plug.

11. (Amended) A pressure vessel capable of withstanding extreme hydrostatic pressure[,] and elevated temperatures, comprising:

a tubular cylindrical casing capable of withstanding external hydrostatic pressures and elevated temperatures having [an internal cavity, and an opening in at least one end permitting access to said internal cavity, said internal cavity having] a hollow interior and an opening in at least one end permitting access to the hollow interior;

[a cylindrical plug region near said opening,]

a component in the [said] hollow interior having at least a first lead[,] required to exit the tubular casing;

an end [a] plug [in said plug region, the plug] having an outer cylindrical surface adapted to [, the outer cylindrical surface of the plug being] force fit in the [plug region] opening of the cylindrical casing, the end plug having a through-hole[,] through its length with a cross-section at least along a part of its length that diminishes in diameter with distance from the opening of the cylindrical casing; [for receiving and passing at least the component first lead to a position outside the pressure vessel, the plug further comprising:] and

a ceramic adhesive plug sealing against a length of the first lead passing through the through hole of the end plug shaped to conform to [formed in] the through-hole in the end plug [by inserting ceramic adhesive into the through-hole and] filling substantially all of the void space within the through-hole not occupied by the lead, [the adhesive being allowed to encapsulate the lead passing through the through-hole,] thereby sealing the [opening] through-hole in the end plug, whereby increased external pressure compresses the ceramic adhesive plug forcing it towards the internal cavity increasing the seal around the lead and around the through-hole in the end plug.

12. (Amended) The pressure vessel of claim 11 wherein [the adhesive is a ceramic adhesive and wherein the tubular cylindrical casing and] the end plug [are] is formed of steel[, the plug further comprising:] and has an O-ring positioned in a channel machined in the plug to receive the O-ring, the O-ring and channel being [characterized] adapted to provide a seal between the outer cylindrical surface of the end plug and the [plug region] opening of the cylindrical casing.

14. (Amended) The pressure vessel of claim 12 wherein the through-hole of the end plug is circular in cross section[, at least a portion of said through-hole has a cross section diminishing in diameter with distance from said opening,] and

the lead exiting the opening [being] is at least a first optical fiber having a plastic jacket covering the cladding, the plastic jacket [of] on the optical fiber length passing through the through-hole being [treated to remove a portion of the jacket,] removed, thereby exposing the cladding, [the adhesive encapsulating a portion of the exposed cladding to] permitting a better seal between the ceramic adhesive plug and the optical fiber [through-hole].

15. (Amended) The pressure vessel of claim 12 wherein the through-hole has an inner surface[,] with at least a portion [of the inner surface] being formed to have an irregular surface region for improved bonding with the ceramic adhesive plug.

16. (Amended) The pressure vessel of claim 14 [wherein the ceramic adhesive plug formed in the through-hole of the plug has an outer surface and wherein said pressure vessel further comprises:] further comprising:

a cap[, said cap being] formed from a polymer material to encapsulate the exposed cladding and to cover and extend beyond the [external surface of said] ceramic adhesive plug thereby forming a fluid barrier over the surface of the plug.

17. (Amended) A pressure vessel capable of withstanding elevated hydrostatic pressures[,] and elevated temperatures comprising:

a tubular cylindrical casing capable of withstanding extreme hydrostatic pressures having [an internal cavity] a hollow interior and a first and second opening at each end permitting access to said [internal cavity, said internal cavity having a] hollow interior; [and

a cylindrical plug region extending inward from said first and second opening]

an optical component in said hollow interior having at least a plurality of optical fiber pigtails extending from [said] the optical component[,] ;

a first and second end plug in [inserted into] the respective first and second [plug regions,] opening, each end plug having an outer cylindrical surface[, the outer cylindrical surface of each respective plug being] adapted to force fit into its respective [plug region] opening of the cylindrical casing, at least one end plug having a through-hole [for receiving and passing at least a portion of the plurality of optical fiber pigtails to a position outside of the pressure vessel, the plug further comprising:] through its length with a cross-section at least along a part of its length that diminishes in diameter with distance from an opening of the cylindrical casing; and

an adhesive plug sealing against a length of the optical fiber pigtails passing through the through-hole of the end plug shaped to conform to [formed in] the through-hole in the end plug [by inserting adhesive into the through-hole and] filling substantially all of the void space within the through-hole not occupied by the optical fiber pigtails, [the adhesive being allowed to encapsulate the optical fiber pigtails passing through the through-hole,] thereby sealing the [opening] through-hole in the end plug.

18. (Amended) The pressure vessel of claim 17 wherein

the tubular cylinder casing and the first and second plugs are formed of steel and wherein [at least a portion of said through-hole has a cross section diminishing in diameter with distance from said opening,]

the optical fibers exiting the opening [being] <u>are</u> at least a first and second optical fiber having a plastic jacket covering the cladding, the plastic jacket [of] <u>on</u> the optical fiber <u>length</u> passing through the through-hole being [treated to remove a portion of the jacket,] <u>removed</u> thereby exposing the cladding[, the adhesive being a ceramic adhesive applied and hardening to encapsulate a portion of the exposed cladding to] <u>permitting a better</u> seal <u>between</u> the [through-hole] <u>ceramic adhesive plug and the optical fiber</u>.

19. (Amended) The pressure vessel of claim 18 wherein the through-hole has an inner surface[,] <u>with</u> at least a portion [of the inner surface] being formed to have an irregular surface region for improved bonding with the [ceramic] adhesive plug.

20. (Amended) The pressure vessel of claim 18 [wherein the ceramic adhesive plug formed in the through-hole of the plug has an outer surface and wherein said pressure vessel further comprises:] <u>further comprising:</u>

a cap[, said cap being] formed from a polymer material to encapsulate a small portion of exposed cladding extending from [said external surface, the cap being formed to cover and extend beyond the external surface of said ceramic] <u>the</u> adhesive plug thereby forming a fluid barrier over the surface of the plug.